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To : William H. Crooks, Executive Officer
California Regional Water Quality Control
Board-Central Valley Region
3443 Routier Road, Suite A
Sacramento, California 95827-3098

Date : January 9, 1992

Place :

From : Department of Pesticide Regulation - 1220 N Street, P.O. Box 942871
Sacramento, California 94271-0001

Subject : 1992 Rice Pesticide Programs

Enclosed is information you requested regarding the Department's rice pesticide program. Included is information on the results of the 1991 program, pesticide use in rice, and the proposed program for 1992 for your review.

Marshall Lee, of my staff, will attend the February 28 meeting and will be available to present information on the proposed 1992 program and answer questions.

If you have any questions regarding the enclosed material, please contact me, or have your staff contact Marshall Lee at 654-0522, or Nan Gorder at 654-0610.

James W. Wells
Interim Director
(916) 654-0551

Enclosures

cc: Marshall Lee
Nan Gorder

Department of Pesticide Regulation
Information on Rice Pesticides
Submitted to the Central Valley Regional Water Quality Control Board
January 10,1992

Programs were implemented since 1983 to reduce discharges of the rice herbicides molinate (Ordram®) and thiobencarb (Bolero®) into surface waterways. In 1990, the objectives of these control efforts were clarified and expanded, following the adoption of amendments to the Central Valley Regional Water Quality Control Board's (Regional Board's) water quality control plan. This plan established performance goals for molinate and thiobencarb, beginning in 1990, and for the insecticides carbofuran (Furadan®), methyl parathion, and malathion, beginning in 1991.

The information provided reviews the factors affecting quantities of molinate, thiobencarb, carbofuran, methyl parathion, and malathion discharged to agricultural drains and the Sacramento River and efforts to meet 1991 performance goals. A summary of pertinent water quality monitoring efforts is also provided. Programs are proposed which will reduce discharges of molinate, thiobencarb, carbofuran, methyl parathion, and malathion to levels which comply with 1992 performance goals.

1991 PROGRAM

PROGRAM DESCRIPTIONS

Molinate

The 1991 molinate program was designed to meet water quality objectives and the 1991 performance goal of 20 parts per billion (ppb) molinate in Sacramento Valley surface waters. The program was implemented using restricted material permits conditioned to mitigate water quality problems associated with use. The conditions included:

1. All water treated with products containing molinate had to be retained on the site of application for at least 24 days following application unless:

a. the treated water was contained within a tailwater recovery system, ponded on fallow land, or contained in other systems appropriate for preventing discharge. The system could discharge 25 days following the last application of molinate within the system.

   1. If the system was under the control of one permittee, treated water could be discharged from the application site in a manner consistent with product labeling.

   2. If the system was under the control of more than one permittee, treated water could be discharged from the application site 9 days following application.

b. the treated water was on acreage within the bounds of specific geographic areas that discharged negligible amounts of rice field drainage into the Sacramento River or its tributaries until fields were drained for harvest. All water on fields treated with molinate had to be retained on the treated acreage for at least 8 days following application.

2. Fields not specified in 1.a. and 1.b. could resume discharging field water 25 days following application at a volume not to exceed two inches of water over a drain box weir. Unregulated discharges from these fields could then resume after 7 days.

3. The county agricultural commissioner could authorize the emergency release of tailwater 7 days following application following a review of a written request (Appendix 1) which clearly demonstrated that the crop was suffering because of the water management requirements. Under an emergency release variance, tailwater could be released only to the extent necessary to mitigate the documented problem. Those issued an emergency release had to submit to the county agricultural commissioner a report (Appendix 2) indicating the time and duration of the emergency release and data that can be used to calculate the total amount of water released during the emergency release.

Thiobencarb

The 1991 thiobencarb program was designed to meet water quality objectives and the 1991 performance goal of 1.5 ppb thiobencarb in Central Valley surface waters. The program was implemented using restricted material permits conditioned to mitigate water quality problems associated with use. The conditions included:

1. All water treated with products containing thiobencarb north of the line defined by Roads E10 and 116 in Yolo County and the American River in Sacramento County had to be retained on the treated fields for at least 30 days following application unless:

a. the treated water was contained within a tailwater recovery system, ponded on fallow land, or contained in other systems appropriate for preventing discharge. The system could discharge 20 days following the last application of thiobencarb within the system.

   1. If the system was under the control of one permittee, treated water could be discharged from the application site in a manner consistent with product labeling.

   2. If the system was under the control of more than one permittee, treated water could be discharged from the application site 7 days following application.

b. the treated water was on acreage within the bounds of specific geographic areas that discharged negligible amounts of rice field drainage into the Sacramento River or its tributaries until fields were drained for harvest. All water on fields treated with thiobencarb had to be retained on the treated acreage for at least 6 days following application.

2. All water treated with products containing thiobencarb south of the line defined by Roads E10 and 116 in Yolo County and the American River in Sacramento County had to be retained on the treated fields for at least 6 days following application.

Valent Chemical Company, distributor of products which contain thiobencarb, agreed to limit the distribution of thiobencarb for use on properties described in 1. above to 4.4 million pounds or enough to treat 110,000 acres. An additional 440,000 pounds could have been used if, on May 1, 1991, flows in the Sacramento River at the "I" Street Bridge in Sacramento were forecast to exceed 15,000 cubic feet per second.

Carbofuran

The 1991 carbofuran program was designed to make progress toward the 1991 performance goal of 0.4 ppb in Central Valley surface waters. The program was implemented using restricted material permits that were conditioned to mitigate water quality problems associated with use. Provisions of this program included:

1. Pre-flood applications of carbofuran to rice fields had to be incorporated into the soil.

2. Water could not be discharged from fields treated with carbofuran for at least 24 days following initial flooding (pre-flood application) or following application (post-plant application) unless the treated water was contained within a tailwater recovery system, ponded on fallow land, or contained in other systems appropriate for preventing discharge. The system could be discharged 25 days following the last application of carbofuran within the system.

   a. If the system was under the control of one permittee, treated water could be discharged from the application site in a manner consistent with product labeling.

   b. If the system was under the control of more than one permittee, treated water could be discharged from the application site 9 days following application.

3. The county agricultural commissioner could authorize the emergency release of tailwater 7 days following application following a review of a written request (Appendix 1) which clearly demonstrated that the crop was suffering because of the water management requirements. Under an emergency release variance, tailwater could be released only to the extent necessary to mitigate the documented problem. Those issued an emergency release had to submit to the county agricultural commissioner a report (Appendix 2) indicating the time and

duration of the emergency release and data that can be used to calculate the total amount of water released during the emergency release.

Methyl parathion

The 1991 methyl parathion program was designed to meet water quality objectives and the 1991 performance goal of 0.26 ppb methyl parathion in Sacramento Valley surface waters. The program was implemented using restricted material permits that were conditioned to mitigate water quality problems associated with use. The conditions included:

1. Water could not be discharged from fields treated with methyl parathion for at least 24 days following application unless the treated water was contained within a tailwater recovery system, ponded on fallow land, or contained in other systems appropriate for preventing discharge. The system could be discharged 25 days following the last application of methyl parathion within the system. Treated water could be discharged from the application site in a manner consistent with product labeling.

2. The county agricultural commissioner could authorize the emergency release of tailwater 7 days following application following a review of a written request (Appendix 1) which clearly demonstrated that the crop was suffering because of the water management requirements. Under an emergency release variance, tailwater could be released only to the extent necessary to mitigate the documented problem. Those issued an emergency release had to submit to the county agricultural commissioner a report (Appendix 2) indicating the time and duration of the emergency release and data that can be used to calculate the total amount of water released during the emergency release.

Malathion

The 1991 malathion program was designed to help meet water quality objectives and the 1991 performance goal of 0.1 ppb malathion in Sacramento Valley surface waters. The program was voluntary because malathion users are not required to obtain restricted material permits. It consisted of a single practice: water should be held on the site of application for at least 4 days following application.

DISCUSSION

The California Department of Pesticide Regulation (CDPR), formally part of the California Department of Food and Agriculture (CDFA), implemented the programs through county agricultural commissioners. Restricted material permits issued for the use of molinate, thiobencarb, carbofuran, and methyl parathion included conditions with the requirements presented above. When permits were issued, a handout (Appendix 3) explaining the voluntary malathion program was provided. Compliance with permit conditions was enforced by the commissioners.

Molinate

The molinate program retained the basic strategies of earlier programs, but in 1991 the water holding requirement for most molinate users increased by five days over the requirement used in 1990. Because the half-life of molinate in treated rice field water is usually three to four days, this new requirement would help reduce peak concentrations of molinate in water discharged by individual growers and help meet the molinate performance goal. Treated water could be recirculated, discharged to fallow fields, or otherwise contained as long as it was not discharged from the system until the 25th day following the last application of molinate to water in the system. If the water in the system was under the control of one permit holder (e.g. contained in a single-grower recirculating system), treated water could be released from the site of application after label requirements (water held 4 days or until weeds were killed) were met. This allowed individual rice growers to manage water on their property with the maximum flexibility. In multi-grower systems which contain discharges from more than one permit holder (e.g. Reclamation District 108), individual permit holders could not discharge treated water into the system until the 9th day following application. The additional dissipation of molinate provided by the additional holding requirement on the site of application helped protect aquatic resources in the public waterways that are presumably part of these multi-grower systems.

The molinate program also included a provision which allowed molinate users to discharge treated water on an emergency basis before the end of the 24 day post-application holding period with the approval of the county agricultural commissioner. Requests for such discharges had to include an inspection report by a licensed pest control advisor, demonstrating that the rice crop was threatened by problems aggravated by the long holding requirement. Only enough water could be discharged to ameliorate the problem.

Thiobencarb

The thiobencarb program also retained the basic structure of earlier programs. Strict water management requirements and a sales limit in the Sacramento Valley of 4.4 million pounds of formulated product were adequate to meet the 1991 performance goal for thiobencarb (1.5 ppb). A similar program was implemented in 1990 with qualified success. Concentrations of thiobencarb in 1990 were kept below detectable levels except immediately following unusual May rains when concentrations at one site reached 2.0 ppb.

Carbofuran

Efforts were made to reduce the discharges of carbofuran from rice fields for the first time in 1991 in an attempt to meet the performance goal of 0.4 ppb. For most fields, where carbofuran was incorporated into soil prior to flooding, permit conditions prohibited the discharge of water from fields to state waters for 24 days following flooding. In fields that were treated after field water was drained, the holding time began with the application. For most fields treated with carbofuran, the 24-day holding times were long enough to overlap with the holding times which follow molinate and thiobencarb applications. Thus, the program provided a carbofuran dissipation period of over a month in most

cases. Provisions of the carbofuran program permitted users to manage field water in single- or multi-grower systems as was provided in the molinate program. An emergency release provision, similar to that available to molinate users, was available to carbofuran users.

Methyl parathion

A methyl parathion performance goal (0.26 ppb) was in place for the first time in 1991 and a discharge reduction program was implemented. Like the carbofuran program, this program required that field water be held on the site of application or within approved water management systems until the 25th day following application. An emergency release provision, similar to that available to molinate users, was available to methyl parathion users.

Malathion

The program to reduce discharges of malathion to surface waterways was voluntary since malathion is not a restricted material and use is not subject to use requirements or permit conditions. Information was provided to rice growers explaining the program when they obtained restricted material permits for other rice pesticides.

USE OF SELECTED PESTICIDES IN 1991

In the rice-growing counties in the Central Valley, county agricultural commissioners record the acreage treated with molinate, thiobencarb, carbofuran, and methyl parathion when Notices-of-Application (NOAs) are submitted to each county office. Based on these records, and on pesticide use reports where available, it was estimated that 326,122 acres were treated with molinate, 24,099 with thiobencarb, 121,517 with carbofuran, and 58,286 with methyl parathion (Table 1). Malathion use on rice was determined by reviewing pesticide use reports; it totalled 9,772 acres. Pesticide use report data for another important rice pesticide, bensulfuron methyl (Londax®), are not available yet. Assuming that use patterns of bensulfuron methyl in 1991 reflected those of 1990 when about 374,000 of the 390,000 planted acres were treated, one can estimate that about 307,000 acres, or about 96% of the 320,000 planted acres were treated with bensulfuron methyl in 1991. Pesticide use in rice was lower than in 1990, reflecting a reduction of rice acreage due to drought.

COUNTY AGRICULTURAL COMMISSIONERS AND ENFORCEMENT ACTIVITIES

The county agricultural commissioners are responsible for the enforcement of the rice pesticide programs. The role of the commissioners and their staffs include explaining the program to growers, pest control advisers and operators; issuing restricted material permits; inspecting fields for compliance; approving emergency release variances; and providing CDPR with information on the use of pesticides.

Before any material on the list of California restricted materials may be applied, growers must obtain a permit from their county agricultural commissioner. The permits may specify conditions for use of the

material, including post-application water holding requirements. A Notice-of-Intent (NOI) must be filed with the county agricultural commissioner 24 hours prior to the application, providing the commissioners with the option to observe the mixing, loading, and application of the material, thus enforcing regulations which pertain to pest control operations. Molinate, thiobencarb, carbofuran, and methyl parathion are currently California restricted materials; malathion is not. Permits which specify post-application water holding requirements, like those for the use of molinate, thiobencarb, carbofuran, and methyl parathion also require that the NOA be filed within 24 hours after the application. Staff of county agricultural commissioners and of CDPR made 4,175 inspections of Sacramento Valley rice fields for compliance with water holding requirements; 28 violations were noted.

County agricultural commissioners had the ability to grant variances on the holding requirements for fields treated with molinate, carbofuran, and methyl parathion if the length of the holding time was adversely affecting the rice plants. Those granted such variances were instructed to drain water only to the extent necessary to restore a healthy growing environment for the rice seedlings.

County agricultural commissioners granted variances for 2,718 acres of rice: 2,224 of the 326,122 acres treated with molinate (Table 2), 1,443 of the 121,517 acres treated with carbofuran, and 1,007 of the 58,286 acres treated with methyl parathion. Most of those acreages were lowered only a few inches in order to correct problems caused by deep water and unfavorable weather conditions. Regional Board staff are compiling information on these emergency releases and their potential impacts on water quality.

COOPERATIVE WATER QUALITY MONITORING PROGRAM

Summaries of the monitoring activities addressing molinate, thiobencarb, bensulfuron methyl, carbofuran, methyl parathion, and malathion in Sacramento Valley waterways in 1991 are presented below. Locations of monitoring sites referenced in this report are presented in Figure 1. Their abbreviations can be interpreted as follows:

CBD1	Colusa Basin Drain at Roads 109 and 99E near Knight's Landing in Yolo County, near its outfall on the Sacramento River.
CBD5	Colusa Basin Drain at Highway 20 in Colusa County.
BS1	Butte Slough at Highway 20 in Sutter County.
SS1	Sacramento Slough at the Department of Water Resources gauge station in Sutter County, near its outfall on the Sacramento River.
SRRUN4	Sacramento River, approximately 3 km downstream from confluence with Colusa Basin Drain, midchannel.
SR1	Sacramento River at Village Marina, approximately 1.5 km upstream from confluence with American River, in Sacramento County.
SR2	Sacramento River at Freeport Bridge in Sacramento County.

SRRAW Sacramento River at the intake to the water treatment facility in Sacramento, approximately 0.3 km downstream from confluence with American River, in Sacramento County.

Molinate and thiobencarb - The molinate and thiobencarb monitoring program in the Sacramento Valley consisted of semi-weekly samples collected from the agricultural drains and the Sacramento River from mid-May through early July by the Department of Fish and Game (DFG). During early May, the early part of the molinate and thiobencarb use period, samples were collected only once a week. Samples were delivered to ICI Americas Inc., manufacturer of Ordram, for molinate and thiobencarb analyses. Split samples representing about 20% of the total collected were analyzed by the DFG laboratory for the presence of both compounds for quality assurance.

The City of Sacramento analyzed water samples collected from the Sacramento River at the intake to its water treatment plant from May 10 through June 19. Samples were collected about three time a week.

Bensulfuron methyl - The DFG collected water samples from the Colusa Basin Drain at CBD1 and Sacramento Slough at SS1 twice each week from May 27 through June 14. After reviewing pesticide use patterns, 8 of the 16 samples were selected on the basis that they would contain the highest bensulfuron methyl concentrations. Bensulfuron methyl has yet to be detected in surface waters at concentrations that are of concern. The samples were analyzed by Morse Laboratories in Sacramento under contract with E. I. du Pont de Nemours and Company, manufacturer of Londax.

Carbofuran - Samples were collected by DFG from the Colusa Basin Drain at CBD1 and CBD5, Sacramento Slough (SS1), and Sacramento River (SR1) twice weekly from April 15 through June 24. Analyses were performed by FMC Corporation who markets Furadan. About 30% of the samples were split with DFG, whose laboratory analyzed the samples for quality assurance.

Methyl parathion and malathion - Samples were collected by DFG from the Colusa Basin Drain at CBD1 and CBD5, Sacramento Slough (SS1), and the Sacramento River (SR1) twice weekly from May 2 through June 13. Analyses were performed by DFG. About 30% of the samples were split with the CDFA laboratory, who analyzed the samples for quality assurance.

RESULTS OF MONITORING PROGRAM

Molinate - Concentrations of molinate in samples collected from agricultural drains and the Sacramento River are presented in Table 3. The highest concentration of molinate detected in these waterways in 1991 was the 26 ppb in Butte Slough (BS1) on June 6 (Figure 2). The highest concentration detected in the Colusa Basin Drain, historically the waterway with the highest concentrations of molinate, was 18 ppb. Figure 3 illustrates peak concentrations of molinate at CBD1 in the years 1981 - 1991, compared to the performance goals established for molinate.

The highest concentration of molinate detected in the Sacramento River was 1.3 ppb in a sample collected from SR1 on June 3. Molinate concentrations detected by the City of Sacramento at the intake to its water treatment facility on the Sacramento River are presented in Table 4. Concentrations peaked on June 3 when 0.6 ppb; a peak of 6.5 ppb was found there in 1990 (Figure 4).

Thiobencarb - No thiobencarb was detected in agricultural drains or the Sacramento River in 1991 (Tables 4 and 5). A perspective of concentrations of thiobencarb at CBD1 and SRRAW are presented in Figures 5 and 6, respectively.

Bensulfuron methyl - Concentrations of bensulfuron methyl detected at CBD1 and SS1 are presented in Table 6. The highest concentration was 0.825 ppb, detected in a sample collected at CBD1 on June 10.

Carbofuran - Results of carbofuran analyses performed by FMC and DFG are presented in Table 7. The peak concentration of carbofuran observed in this survey was 0.6 ppb, detected in a water sample taken from the Colusa Basin Drain at CBD5 on May 9 (Figure 7). Carbofuran was not detected in the Sacramento River in 1991.

Methyl parathion and malathion - Results of methyl parathion and malathion analyses performed by the DFG laboratory are presented in Tables 8 and 9, respectively. Data from the quality control laboratory (CDFA) are also presented. The highest concentration of methyl parathion in this survey was 0.30 ppb, detected in a sample collected from the Colusa Basin Drain at CBD5 (Figure 8) on May 23. The highest concentrations detected at CBD1 and SS1 were 0.20 ppb and 0.10 ppb, respectively. The highest malathion concentrations (Figure 9) were the 0.30 ppb at SS1 (May 16) and the 0.20 ppb at CBD1 (May 27 and 30). The quality control data do not suggest that the DFG data are questionable. No methyl parathion or malathion were detected in the Sacramento River in 1991.

MASS TRANSPORT IN THE SACRAMENTO RIVER

The total mass of molinate and thiobencarb transported in the Sacramento River past Sacramento may be used to compare the pesticide load in the river in different years. Mass transport cannot be used to determine compliance with performance goals. The estimated mass transport of molinate and thiobencarb in the Sacramento River past Sacramento during 1982 through 1991 is presented in Table 10. The mass transport of molinate in 1991 was estimated to be 99 kg (218 lbs), a reduction of 96.9% from 1990 totals and a 99.5% reduction since 1982. Since thiobencarb was not detected in the Sacramento River in 1991, transport mass is assumed to be zero.

WEATHER AND ITS INFLUENCE ON WATER QUALITY

Weather conditions during and after applications of rice pesticides may influence the performance of water quality control programs. Dissipation rates of many pesticides, e.g. molinate, increase with increasing

temperature, so warm weather during water holding periods helps reduce concentrations once post-application discharges resume. The unusually hot weather in May, 1987 helped explain why concentrations in waterways and mass transport in the Sacramento River were relatively low that year. Conversely, May 1990 was cool and rainy and the results of the molinate program were not successful. Thus, it is important to be aware of weather patterns when reviewing monitoring data.

In 1991, the temperatures during the beginning of the application season for molinate and thiobencarb (Figure 10) were generally much cooler than normal. The weather in the remainder of the application season was more seasonable. The dissipation of rice pesticides from rice field water was probably lower than that expected in a "normal" year, but not to an unusual degree.

WATER FLOW PATTERNS AND THEIR INFLUENCE ON WATER QUALITY

Drought conditions in 1991 reduced flows in many surface waterways, even in those dependent on agricultural return flows. In some cases this provided less dilution for rice field discharges and concentrations may have been higher than in more normal years. For example, Butte Creek previously flowed at volumes sufficient to dilute rice field discharges five-fold at the Butte Slough monitoring site (BS1). No such dilution was possible in 1991 and water sampled at BS1 was essentially all runoff from rice fields. Thus, with more normal flow patterns, concentrations of rice pesticides at that site would probably be much lower. In contrast, flows in the Colusa Basin Drain are highly dependent on return from rice fields and are not appreciably diluted with water from other sources. While water flows in the Colusa Basin Drain were low in 1991 because of low rice acreage and water conservation measures, concentrations of rice pesticides there were probably not greatly affected by the drought.

Low flow volumes in the major agricultural drains also helped minimize inputs into the Sacramento River and concentrations of pesticides measured in the river were very low or not detectable. This also resulted in a great reduction in the mass of molinate and thiobencarb transported in the Sacramento River past Sacramento.

APPLICATION DRIFT AND ITS INFLUENCE ON WATER QUALITY

Aerial applications of pesticides have the potential to move off-site and into adjacent waterways. Evidence suggests that drift had a significant effect on water quality in 1991 and was the most significant contributor of rice pesticides to surface waterways. Indirect evidence for such contributions can be seen by comparing the occurrence of the peak concentrations of molinate, carbofuran and methyl parathion in agricultural drains and the timing of the applications of these pesticides.

The effects of discharges from a treated field on concentrations found at a downstream monitoring site would not be known for at least 28 days following the application, assuming the field water was contained for the 24 day minimum and discharged water took 4 days to travel from the field to the monitoring site. If the presence of pesticides in agricultural drains were due to discharges alone, the highest concentrations would be expected about four weeks following the heaviest application periods in the catchments upstream from the monitoring sites. However, the highest concentrations of molinate occurred well before anticipated discharge peaks and were more closely associated with application periods. Figures 11 and 12 illustrate that the peak concentrations of molinate in the Colusa Basin Drain and Butte Slough, respectively, could not have been due to legal releases 25 days after application.

There is a significant relationship between the number of rice acres treated with molinate in Glenn and Colusa Counties and concentrations of molinate in water samples collected at CBD5 during the application period (correlation coefficient = 0.767, $p = 0.0159$). For this correlation, five day running averages of rice acres treated with molinate, encompassing the fourth through the eighth days of application prior to the water monitoring sample collection date, allowed for the variable transit times of molinate residues from the sites of application to the monitoring site. Only those molinate concentrations which could not be attributed to legal releases after a minimum 24 day holding period (eight dates between May 4 and June 6) were included in the correlation.

Carbofuran and methyl parathion concentrations in the Colusa Basin Drain also peaked during the application periods, as shown in Figures 13 and 14, respectively. These figures also suggest that the 1991 programs were adequate for reducing discharge and meeting 1991 and 1992 performance goals.

The malathion program included a holding period of only four days and it was not possible to determine whether the occurrence of malathion in waterways was more closely associated with anticipated discharges or with other events.

Empirical data are available which indicate that an important source of methyl parathion contamination is from aerial drift. Research conducted by CDPR in 1991 indicated that during routine methyl parathion applications to rice fields, methyl parathion was deposited into adjacent drainage ditches and to ditch banks. Methyl parathion in these ditches peaked at concentrations ranging from 2.8 to 16.7 ppb above background (0.05 ppb or less) shortly following applications, then concentrations declined as contaminated water moved downstream.

Other potential sources of such contamination at this point in the production schedule for rice include discharge gates (drop boxes) that leak during water holding periods; subterranean movement of treated field water to agricultural drains; and discharges from fields draining under emergency release provisions.

1992 PROGRAM

PROGRAM DESCRIPTIONS

Molinate

The 1992 molinate program is designed to meet water quality objectives and the 1992 performance goal of 10 ppb molinate in Sacramento Valley surface waters. The program will be implemented using restricted material permits conditioned to mitigate water quality problems associated with use. The conditions include:

1. All water treated with products containing molinate must be retained on the site of application for at least 28 days following application unless:

a. the treated water is contained within a tailwater recovery system, ponded on fallow land, or contained in other systems appropriate for preventing discharge. The system may discharge 29 days following the last application of molinate within the system.

   1. If the system is under the control of one permittee, treated water may be discharged from the application site in a manner consistent with product labeling.

   2. If the system is under the control of more than one permittee, treated water may be discharged from the application site 9 days following application.

b. the treated water is on acreage within the bounds of specific geographic areas that discharge negligible amounts of rice field drainage into the Sacramento River or its tributaries until fields are drained for harvest. All water on fields treated with molinate must be retained on the treated acreage for at least 8 days following application.

2. Fields not specified in 1.a. and 1.b. may resume discharging field water 29 days following application at a volume not to exceed two inches of water over a drain box weir. Unregulated discharges from these fields may then resume after 7 days.

3. The county agricultural commissioner may authorize the emergency release of tailwater 7 days following application following a review of a written request (Appendix 1) which clearly demonstrates the crop is suffering because of the water management requirements. Additionally, the requester must describe preventative action that would avoid the need for future emergency releases. Under an emergency release variance, tailwater may be released only to the extent necessary to mitigate the documented problem. Those issued an emergency release must submit to the county agricultural commissioner a report (Appendix 2) indicating the time and duration of the emergency release and data that can be used to calculate the total amount of water released during the emergency release.

Thiobencarb

Since the 1992 performance goal of thiobencarb is not yet established and since the 1991 thiobencarb program is probably adequate to meet any performance goal that may reasonably be established for thiobencarb, the 1992 thiobencarb will be the same as that used in 1991. The program will be implemented using restricted material permits conditioned to mitigate water quality problems associated with use. The conditions include:

1. All water treated with products containing thiobencarb north of the line defined by Roads E10 and 116 in Yolo County and the American River in Sacramento County must be retained on the treated fields for at least 30 days following application unless:

a. the treated water is contained within a tailwater recovery system, ponded on fallow land, or contained in other systems appropriate for preventing discharge. The system may discharge 20 days following the last application of thiobencarb within the system.

    1. If the system is under the control of one permittee, treated water may be discharged from the application site in a manner consistent with product labeling.

    2. If the system is under the control of more than one permittee, treated water may be discharged from the application site 7 days following application.

b. the treated water is on acreage within the bounds of specific geographic areas that discharge negligible amounts of rice field drainage into the Sacramento River or its tributaries until fields are drained for harvest. All water on fields treated with thiobencarb must be retained on the treated acreage for at least 6 days following application.

2. All water treated with products containing thiobencarb south of the line defined by Roads E10 and 116 in Yolo County and the American River in Sacramento County must be retained on the treated fields for at least 6 days following application.

Valent Chemical Company, distributor of products which contain thiobencarb, agreed to limit the distribution of thiobencarb for use on properties described in 1 above to 4.4 million pounds or enough to treat 110,000 acres.

Carbofuran

The 1992 carbofuran program will be the same as the 1991 program. It is designed to maintain carbofuran discharges at low levels and to help assure compliance with the 1992 performance goal of 0.4 ppb in Central Valley surface waters. The program will be implemented using restricted material permits that are conditioned to mitigate water quality problems associated with use. Provisions of this program include:

1. Pre-flood applications of carbofuran to rice fields must be incorporated into the soil.

2. Water shall not be discharged from sites treated with carbofuran for at least 24 days following initial flooding (pre-flood application) or following application (post-plant application) unless the treated water is contained within a tailwater recovery system, ponded on fallow land, or contained in other systems appropriate for preventing discharge. The system may discharge 25 days following the last application of carbofuran within the system.

   a. If the system is under the control of one permittee, treated water may be discharged from the application site in a manner consistent with product labeling.

   b. If the system is under the control of more than one permittee, treated water may be discharged from the application site 9 days following application.

3. The county agricultural commissioner may authorize the emergency release of tailwater 7 days following application following a review of a written request (Appendix 1) which clearly demonstrates the crop is suffering because of the water management requirements. Additionally, the requester must describe preventative action that would avoid the need for future emergency releases. Under an emergency release variance, tailwater may be released only to the extent necessary to mitigate the documented problem. Those issued an emergency release must submit to the county agricultural commissioner a report (Appendix 2) indicating the time and duration of the emergency release and data that can be used to calculate the total amount of water released during the emergency release.

Methyl parathion

The 1992 methyl parathion program will be the same as the 1991 program. It is designed to maintain methyl parathion discharges at low levels and to help assure compliance with the 1992 performance goal of 0.13 ppb in Central Valley surface waters. The program will be implemented using restricted material permits that are conditioned to mitigate water quality problems associated with use. Provisions of this program include:

1. Water shall not be discharged from sites treated with methyl parathion for at least 24 days following application unless the treated water is contained within a tailwater recovery system, ponded on fallow land, or contained in other systems appropriate for preventing discharge. The system may discharge 25 days following the last application of methyl parathion within the system. Treated water may be discharged from the application site in a manner consistent with product labeling.

2. The county agricultural commissioner may authorize the emergency release of tailwater 7 days following application following a review of a written request (Appendix 1) which clearly demonstrates the crop is suffering because of the water management requirements. Additionally, the requester must describe preventative action that would avoid the need for future emergency releases. Under an emergency release variance, tailwater may be released only to the extent

necessary to mitigate the documented problem. Those issued an emergency release must submit to the county agricultural commissioner a report (Appendix 2) indicating the time and duration of the emergency release and data that can be used to calculate the total amount of water released during the emergency release.

Malathion

The 1992 malathion program will be the same as the 1991 program. It is designed to maintain malathion discharges at low levels and help, along with efforts to minimize spray drift, to assure compliance with the 1992 performance goal of 0.1 ppb in Central Valley surface waters. The program will consist of a single practice: water should be held on the site of application for at least 4 days following application.

Additional Features

The CDPR will continue efforts to reduce contributions of rice pesticides to surface waterways from two potentially important sources: aerial drift and water discharged under emergency release provisions.

DISCUSSION

Molinate

The 1992 molinate program relies upon the basic strategy used since 1984; mandatory water holding periods following application will be used to allow molinate to dissipate before field water is discharged. By successively increasing the water holding requirements for molinate users, molinate discharges from treated acreage and concomitant concentrations in agricultural drains and the Sacramento River have declined dramatically. In 1991, concentrations due to discharges were apparently so low that other sources of molinate contamination, e.g. drift, were the most significant contributor of molinate to Sacramento Valley waterways. Although it appears that the peak concentrations of molinate in agricultural drains cannot be attributable to discharges from treated fields, such discharges probably loaded enough molinate in agricultural drains to exceed 10 ppb, the performance goal for 1992. Therefore, in order to better meet the 1992 performance goal, even under unfavorable weather conditions, the proposed molinate program increases the water holding requirement for most molinate users from 24 to 28 days. Since the dissipation half-life of molinate is usually between three and four days, increasing the holding period can significantly affect molinate discharges and concentrations in receiving waters.

Thiobencarb

The proposed thiobencarb program is the same as the program implemented in 1991. This program was successful in meeting the 1991 performance goal. Strict water management requirements and a sales limit in the Sacramento Valley of 4.4 million pounds of formulated product will continue to keep thiobencarb concentrations in the surface waters very low and below the 1992 performance goal, anticipated to be 1.5 ppb.

Carbofuran

The proposed carbofuran program is the same as the program implemented in 1991. This program was adequate to meet the 1991 and 1992 performance goals of 0.4 ppb, since the only detection of carbofuran in excess of these goals could not have been the result of discharges from treated fields.

An emergency release provision, similar to that available to molinate users, will be available to carbofuran users.

Methyl Parathion

The proposed methyl parathion program is the same as the program implemented in 1991. This program was adequate to meet the 1991 and 1992 performance goals of 0.26 and 0.13 ppb, respectively, since the only detections of methyl parathion in excess of these goals could not have been the result of discharges from treated fields.

A CDPR study conducted in 1991 demonstrated how rapidly methyl parathion dissipates from rice field water and the value of water holding strategies in reducing methyl parathion discharges. It was estimated that methyl parathion concentrations in field water in of treated rice fields would decline from a post-application peak of 1,890 ppb to 0.38 ppb or lower by the 24th day following application.

An emergency release provision, similar to that available to molinate users, will be available to methyl parathion users.

Malathion

The proposed malathion program is the same as the program implemented in 1991, since it was concluded that the presence of malathion in agricultural drains was not attributable to discharges but rather from aerial drift.

Additional Features

During 1992, CDPR will develop and implement a program to reduce concentrations of rice pesticides in surface waterways due to aerial drift. This may be the most significant component of the 1992 program since aerial drift is now probably the most significant contributor of rice pesticides to surface waterways. The CDPR is considering options which will reduce aerial drift, including conditioning restricted material permits to insure that those who apply molinate, thiobencarb, carbofuran, or methyl parathion to rice fields will take the precautions needed to minimize drift to waterways.

Field water discharged under emergency release provisions must be minimized in order to assure that performance goals are met. Reporting requirements implemented in 1991 will help county agricultural commissioners screen those who apply for emergency releases and better identify those who have a legitimate need for such releases. Emergency release variances should not be issued to those seeking a convenient remedy for poor water management. Those who request variances yearly will be identified and permits may be conditioned to assure that reasonable steps are taken to prevent recurrence.

ADDITIONAL INFORMATION

The rice industry predicts the California rice acreage to be about 350,000 acres in 1992, an increase of about 10% over the 1991 rice acreage. Presumably, the use of rice pesticides will increase accordingly.

Table 1. Acres treated with molinate (Ordram®)[1], thiobencarb (Bolero®), carbofuran (Furadan®), methyl parathion, and malathion in the counties of the Sacramento and San Joaquin Valleys in 1991[2].

County	Acres treated				
	molinate	thiobencarb	carbofuran	methyl parathion	malathion
Butte	64,834	2,251	32,260	3,650	155
Colusa	87,602	7,223	35,388	24,687	1,085
Fresno	1,511	0	0	0	0
Glenn	61,177	647	19,189	6,195	0
Merced	1,272	20	0	0	0
Placer	10,519	1,796	5,637	1,568	540
Sacramento	5,862	1,253	1,698	1,591	824
San Joaquin	4,333	0	718	0	0
Stanislaus	2,034	0	138	0	0
Sutter	53,514	3,555	10,101	12,444	4,352
Tehama	651	0	0	0	0
Yolo	5,344	7,288	453	446	595
Yuba	27,469	66	15,935	7,705	2,221
Totals					
Sacramento Valley	316,972	24,079	120,661	58,286	9,772
San Joaquin Valley	9,150	20	856	0	0
Overall	326,122	24,099	121,517	58,286	9,772

1. Values higher than estimated rice acreage in 1991 because molinate may be applied more than once at each site.

2. Values are based on Notices-of-Application submitted to county agricultural commissioners in the Sacramento Valley, except Colusa and Glenn Counties. Values for use in the San Joaquin Valley and in Colusa and Glenn Counties are based on 1991 Pesticide Use Reports.

Table 2. Acres of molinate-treated rice fields where water was discharged under emergency release variances in the Sacramento Valley in 1987 - 1991.

Year	Acres	Percent of total acres treated
1987	5,712	1.94
1988	4,897	1.41
1989	3,235	0.86
1990	23,394	6.32
1991	2,224	0.70

Table 3. Molinate concentrations at seven monitoring sites[1] in the Sacramento Valley in 1991[2].

	Concentration (ppb)						
Date	CBD1	CBD5	SS1	BS1	SRRUN4	SR1	SR2
5/9	ND[3]	2.3	ND	ND	[4]	ND	ND
5/13	2.9	8.6	ND	ND		ND	ND
5/20	9.2	18	1.1	2.1		ND	ND
5/23	13	16	1.9	5.3		ND	ND
5/27	13	15	5.5	10	1.0	ND	ND
5/30	18	14	5.2	21	ND	1.2	ND
6/3	17	17	6.9	22	1.3	1.3	ND
6/6	16	14	7.5	26	ND	ND	ND
6/10	11	9.6	7.9	10	ND	ND	ND
6/13	10	12	9.6	5.3	ND	ND	ND
6/17	8.7	13	7.4	6.0	ND	ND	ND
6/20	8.1	13	6.2	11		ND	
6/24	7.4	4.0	3.4	7.4		ND	
7/1	3.5	5.1	5.3	6.2		ND	
7/4	3.5	3.4	3.1	5.9		ND	
7/8	3.3	3.0	2.6	5.7		ND	

1. CBD1 Colusa Basin Drain at Roads 109 and 99E near Knight's Landing in Yolo County.
   CBD5 Colusa Basin Drain at Highway 20 in Colusa County.
   SS1 Sacramento Slough at DWR gauge station in Sutter County.
   BS1 Butte Slough at Highway 20 in Sutter County.
   SRRUN4 Sacramento River, 3 km downstream from confluence with Colusa Basin Drain.
   SR1 Sacramento River at Village Marina in Sacramento County.
   SR2 Sacramento River at Freeport Bridge in Sacramento County.

2. Samples collected by the California Department of Fish and Game and analyzed by ICI Americas, Inc.

3. ND None detected. Limit of detection = 1.0 ppb.

4. Blanks in table indicate that no samples were taken.

Table 4. Concentrations of molinate and thiobencarb in the Sacramento River at the intake to the City of Sacramento water treatment facility in 1991[1].

Date	Concentration (ppb) molinate	thiobencarb	Date	Concentration (ppb) molinate	thiobencarb
5/10	ND[1]	ND	6/3	0.60	ND
5/14	ND	ND	6/5	ND	ND
5/17	ND	ND	6/7	0.12	ND
5/20	ND	ND	6/10	ND	ND
5/22	ND	ND	6/12	0.12	ND
5/24	0.11	ND	6/14	0.10	ND
5/27	0.20	ND	6/17	ND	ND
5/29	0.25	ND	6/19	ND	ND
5/31	0.19	ND			

1. Samples collected and analyzed by the City of Sacramento.

2. ND None detected. Limits of detection = 0.5 ppb (5/10 - 5/14), 0.10 ppb (5/17 - 6/19).

Table 5. Thiobencarb concentrations at seven monitoring sites[1] in the Sacramento Valley in 1991[2].

	Concentration (ppb)						
Date	CBD1	CBD5	SS1	BS1	SRRUN4	SR1	SR2
5/9	ND[3]	ND	ND	ND	[4]	ND	ND
5/13	ND	ND	ND	ND		ND	ND
5/20	ND	ND	ND	ND		ND	ND
5/23	ND	ND	ND	ND		ND	ND
5/27	ND	ND	ND	ND	ND	ND	ND
5/30	ND	ND	ND	ND	ND	ND	ND
6/3	ND	ND	ND	ND	ND	ND	ND
6/6	ND	ND	ND	ND	ND	ND	ND
6/10	ND	ND	ND	ND	ND	ND	ND
6/13	ND	ND	ND	ND	ND	ND	ND
6/17	ND	ND	ND	ND	ND	ND	ND
6/20	ND	ND	ND	ND		ND	ND
6/24	ND	ND	ND	ND		ND	ND
7/1	ND	ND	ND	ND		ND	ND
7/4	ND	ND	ND	ND		ND	ND
7/8	ND	ND	ND	ND		ND	ND

1. CBD1 Colusa Basin Drain at Roads 109 and 99E near Knight's Landing in Yolo County.
   CBD5 Colusa Basin Drain at Highway 20 in Colusa County.
   SS1 Sacramento Slough at DWR gauge station in Sutter County.
   BS1 Butte Slough at Highway 20 in Sutter County.
   SRRUN4 Sacramento River, 3 km downstream from confluence with Colusa Basin Drain.
   SR1 Sacramento River at Village Marina in Sacramento County.
   SR2 Sacramento River at Freeport Bridge in Sacramento County.

2. Samples collected by the California Department of Fish and Game and analyzed by ICI Americas, Inc.

3. ND None detected. Limit of detection = 1.0 ppb.

4. Blanks in table indicate that no samples were taken.

Table 6. Concentrations of bensulfuron methyl detected at two sites[1] in the Sacramento Valley in 1991[2].

	Bensulfuron methyl (ppb)	
Date	CBD1	SS1
5/30	0.625	ND[3]
6/3	0.800	ND
6/6	0.750	ND
6/10	0.825	ND

1. CBD1 Colusa Basin Drain at Roads 109 and 99E near Knight's Landing in Yolo County.
   SS1 Sacramento Slough at DWR gauge station in Sutter County.

2. Samples collected by the California Department of Fish and Game and analyzed by Morse Laboratories under contract with Du Pont.

3. ND None detected, limit of detection = 0.5 ppb.

Table 7. Concentrations of carbofuran (Furadan®) detected in Sacramento Valley waterways[1] in 1991, reported by two laboratories[2].

Date Collected	Carbofuran (ppb)						
	CBD1		CBD5		SS1		SR1
	FMC	CDFG	FMC	CDFG	FMC	CDFG	FMC
4/15	ND[3]		ND		ND		ND
4/18	ND		0.1		ND		ND
4/22	ND	ND	ND		ND	ND	ND
4/25	ND		0.2		ND		ND
4/29	0.1	ND	0.2		ND[4]		ND
5/2	ND		0.1		ND	ND	ND
5/6	ND	ND	0.2	ND	ND		ND
5/9	0.1		0.6[4]		ND		ND
5/13	0.2	ND	0.2[4]	ND	ND		ND
5/16	0.3		0.4		ND		ND
5/20	0.2	ND	0.3[4]	ND	ND		ND
5/23	ND		0.2		ND		ND
5/27	0.1	ND	0.4	ND	ND	ND	ND
5/30	0.3		0.2		ND		ND
6/3	0.1	ND	0.3	ND	ND	ND	ND
6/6	ND		0.3		ND		ND
6/10	ND		0.5[4]		ND		ND
6/13	ND		0.2		ND		ND
6/17	ND	ND	0.2	ND	ND	ND	ND
6/20	ND		0.1		ND		ND
6/24	ND	ND	0.2	ND	ND	ND	ND
6/27	0.1		0.6		ND		ND
7/4	ND		0.5		ND		ND
7/8	ND		0.5		ND		ND

1. CBD1 Colusa Basin Drain at Roads 109 and 99E near Knight's Landing in Yolo County.
   CBD5 Colusa Basin Drain at SR 20 in Colusa County.
   SS1 Sacramento Slough at DWR gauge station in Sutter County.
   SR1 Sacramento River at Village Marina in Sacramento County.

2. CDFG California Department of Fish and Game, Water Pollution Control Laboratory, Rancho Cordova.
   FMC FMC Corporation, Agricultural Chemical Group, Richmond, CA.

3. ND None detected, limit of detection = 0.1 ppb. FMC reported a limit of quantitation of 0.4 ppb.

4. Result represents an average of two independent analyses performed on the same sample.

Table 8. Concentrations of methyl parathion detected in Sacramento Valley waterways[1] in 1991, reported by two laboratories[2].

Date Collected	Methyl parathion (ppb)						
	CBD1		CBD5		SS1		SR1
	CDFG	CDFA	CDFG	CDFA	CDFG	CDFA	CDFG
5/2	ND[3]		ND		ND		ND
5/6	ND	ND	ND	ND	ND		ND
5/9	ND		ND		ND		ND
5/13	ND	ND	ND	0.17	ND		ND
5/16	ND		ND		ND		ND
5/20	0.10	0.12	0.20	0.23	ND		ND
5/23	0.20		0.30		ND		ND
5/27	ND	0.12	ND	0.08	0.10	0.14	ND
5/30	ND		ND		ND		ND
6/3	0.10	0.09	0.10	0.09	ND	ND	ND
6/5	ND		ND		ND		ND
6/10		ND		ND		ND	
6/13	ND		ND		ND		ND

1. CBD1 Colusa Basin Drain at Roads 109 and 99E near Knight's Landing in Yolo County.
   CBD5 Colusa Basin Drain at SR 20 in Colusa County.
   SS1 Sacramento Slough at DWR gauge station in Sutter County.
   SR1 Sacramento River at Village Marina in Sacramento County.

2. CDFG California Department of Fish and Game, Water Pollution Control Laboratory, Rancho Cordova.
   CDFA California Department of Food and Agriculture, Chemistry Laboratory Services, Sacramento.

3. ND None detected, limits of detection = 0.10 ppb (CDFG) and 0.05 ppb (CDFA).

Table 9. Concentrations of malathion detected in Sacramento Valley waterways[1] in 1991, reported by two laboratories[2].

Date Collected	Malathion (ppb) CBD1 CDFG	CBD1 CDFA	CBD5 CDFG	CBD5 CDFA	SS1 CDFG	SS1 CDFA	SR1 CDFG
5/2	ND[3]		ND		ND		ND
5/6	ND	ND	ND	ND	ND		ND
5/9	ND		ND		ND		ND
5/13	ND	ND	ND	ND	ND		ND
5/16	ND		ND		0.30		ND
5/20	ND	ND	ND	0.05	ND		ND
5/23	ND		ND		ND		ND
5/27	ND	0.11	0.20	0.12	ND	ND	ND
5/30	ND		0.20		ND		ND
6/3	ND	ND	ND	ND	ND	ND	ND
6/5	ND		ND		ND		ND
6/10		ND		ND		ND	
6/13	ND		ND		ND		ND

1. CBD1 Colusa Basin Drain at Roads 109 and 99E near Knight's Landing in Yolo County.
   CBD5 Colusa Basin Drain at SR 20 in Colusa County.
   SS1 Sacramento Slough at DWR gauge station in Sutter County.
   SR1 Sacramento River at Village Marina in Sacramento County.

2. CDFG California Department of Fish and Game, Water Pollution Control Laboratory, Rancho Cordova.
   CDFA California Department of Food and Agriculture, Chemistry Laboratory Services, Sacramento.

3. ND None detected, limits of detection = 0.10 ppb (CDFG) and 0.05 ppb (CDFA).

Table 10. Estimated mass transport of molinate and thiobencarb in the Sacramento River past Sacramento in the years 1982-1991.

Year	Kg (pounds) Transported molinate		thiobencarb[1]	
1982	18,464.9	(40,666.9)		
1983[2]	2,752.9	(6,056.5)	623.7	(1,372.2)
1984	7,352.0	(16,174.4)	715.2	(1,573.5)
1985	6,014.8	(13,232.5)	2,317.5	(5,098.6)
1986	4,622.1	(10,168.7)	845.7	(1,860.6)
1987	2,342.3	(5,153.2)	22.8	(50.2)
1988	3,194.2	(7,027.2)	68.1	(149.8)
1989	1,984.1	(4,365.1)	11.4	(25.1)
1990	3,204.1	(7,049.1)	51.4	(113.1)
1991	99.2	(217.9)	0	(0)[3]

1. Mass transport was not calculated due to incomplete monitoring data.

2. The Colusa Basin Drain, a major agricultural drain, did not contribute to the mass transport at Sacramento because the drain was routed into the Yolo Bypass during unusually high Sacramento River flows.

3. Thiobencarb was not detected in the Sacramento River in 1991 (limit of detection = 0.1 ppb).

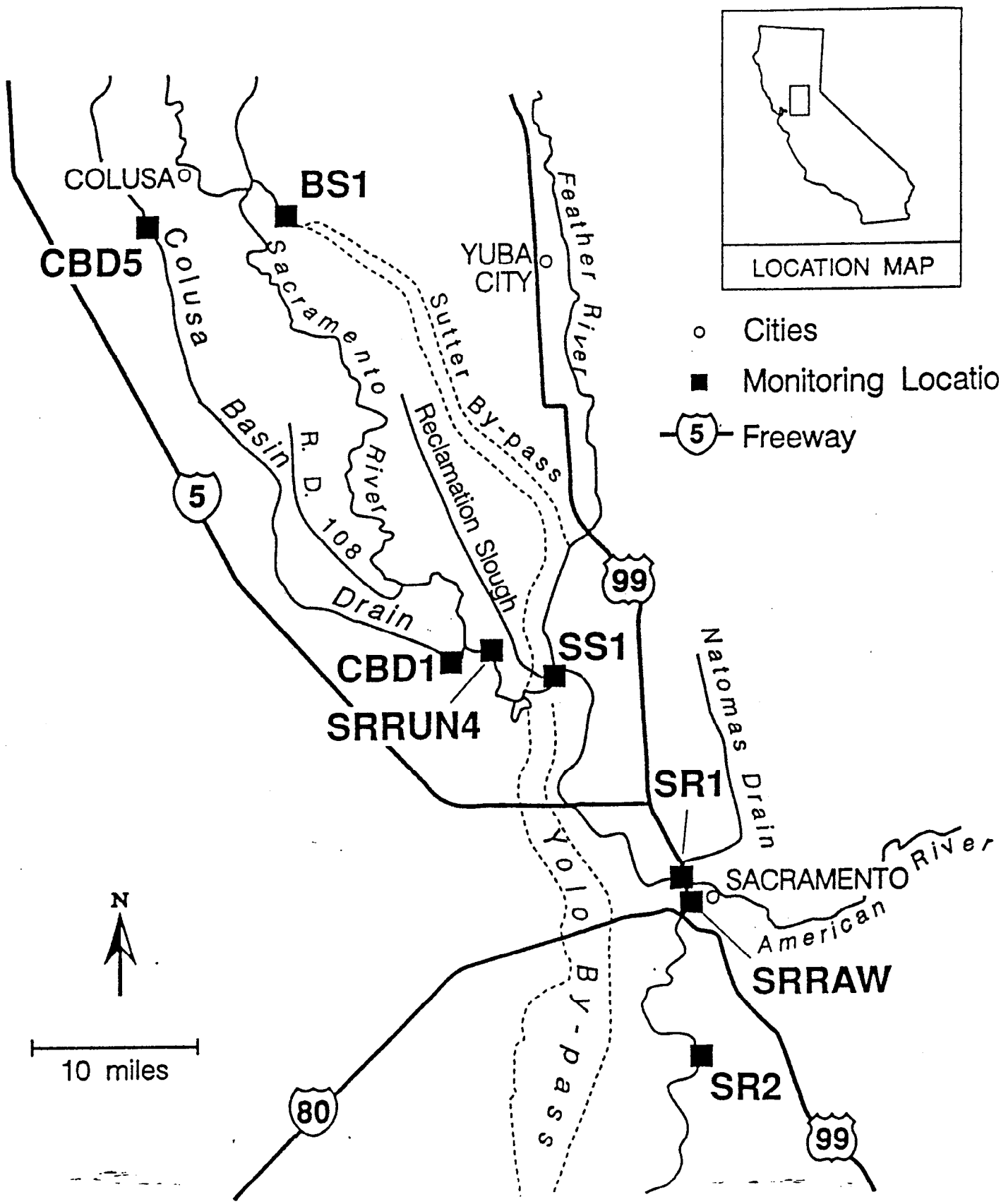
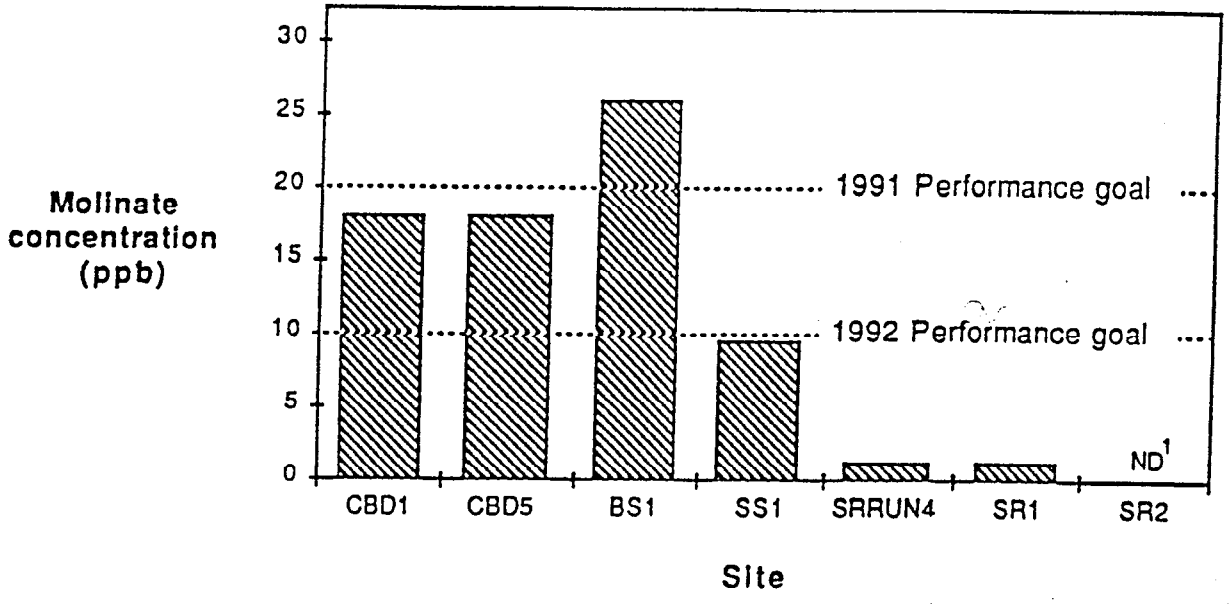


Figure 1. Monitoring sites on Sacramento Valley waterways.

Figure 2. Peak molinate concentrations in Sacramento Valley waterways in 1991 and molinate performance goals for 1991 and 1992.



ND None detected. Limit of detection = 1.0 ppb.

Figure 3. Peak molinate concentrations in the Colusa Basin Drain near Knight's Landing (CBD1) in 1981-1991 and molinate performance goals.

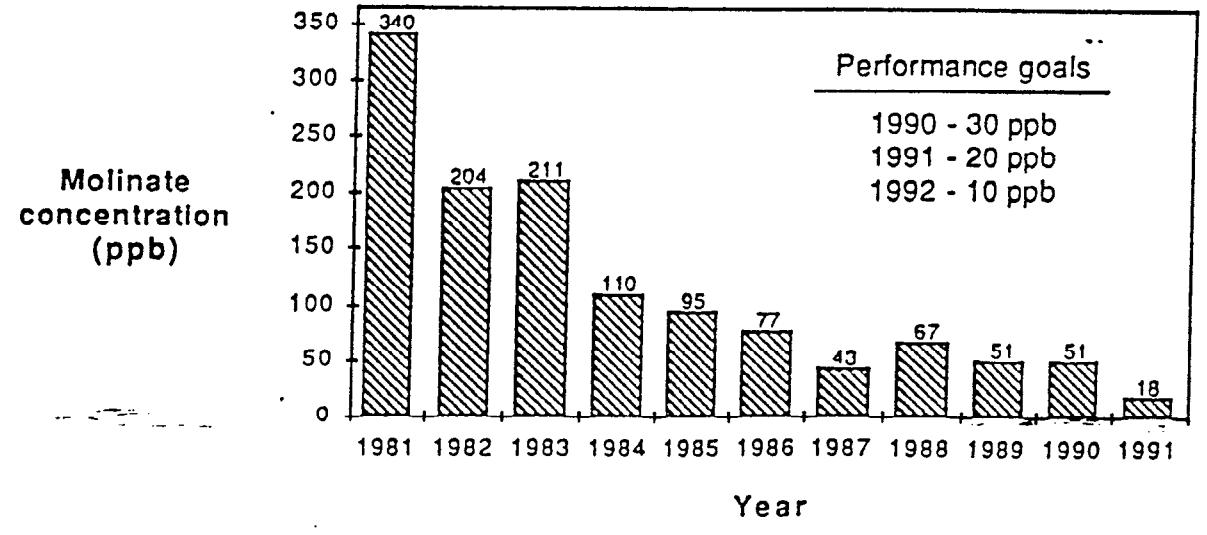


Figure 4. Peak molinate concentrations in the Sacramento River at Sacramento in 1982-1991 and the maximum contaminant level for molinate.

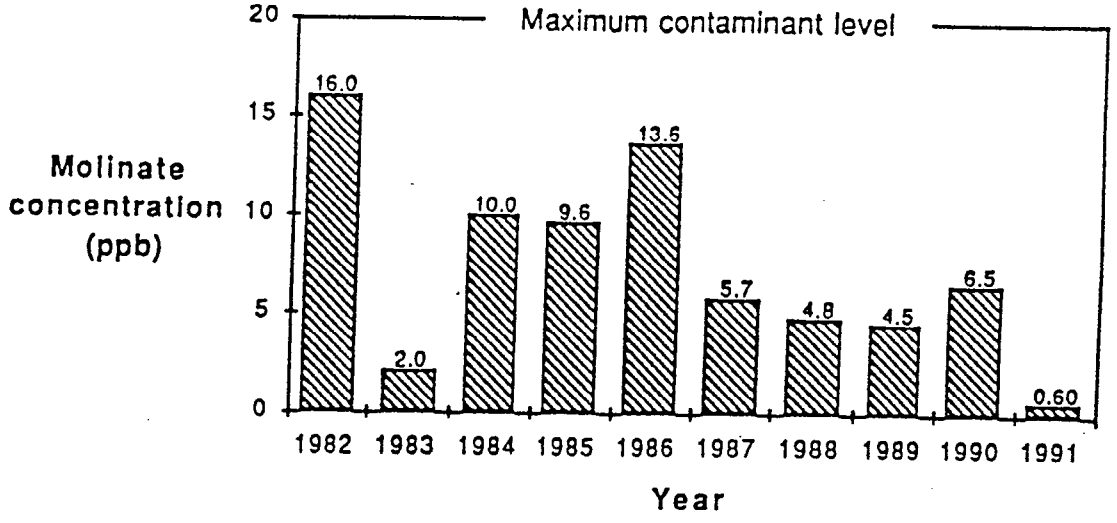


Figure 5. Peak thiobencarb concentrations in the Colusa Basin Drain near Knight's Landing (CBD1) in 1981-1991 and thiobencarb performance goals.

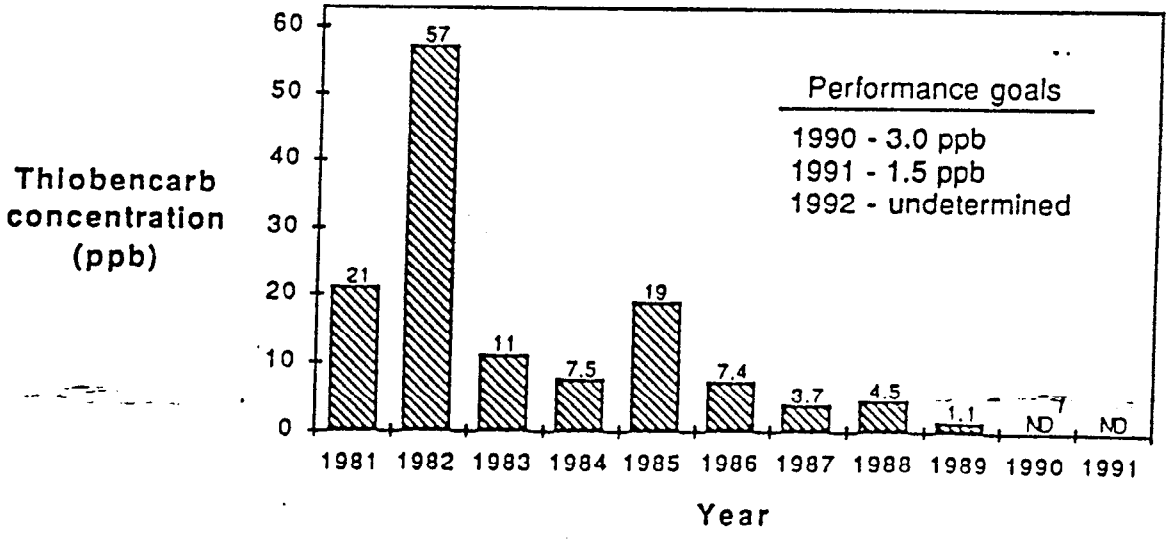
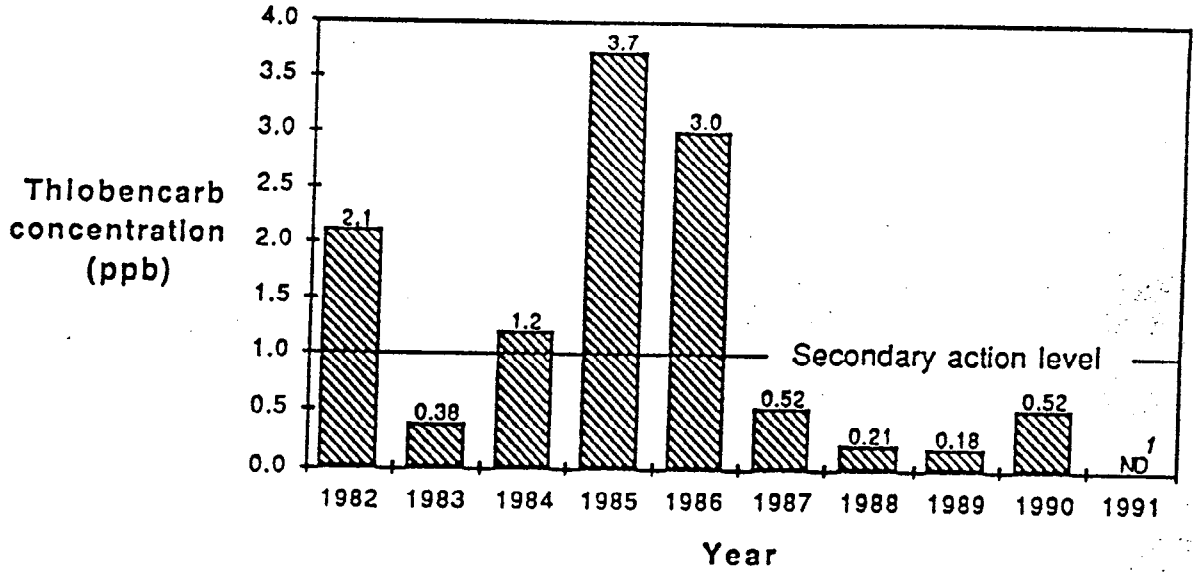
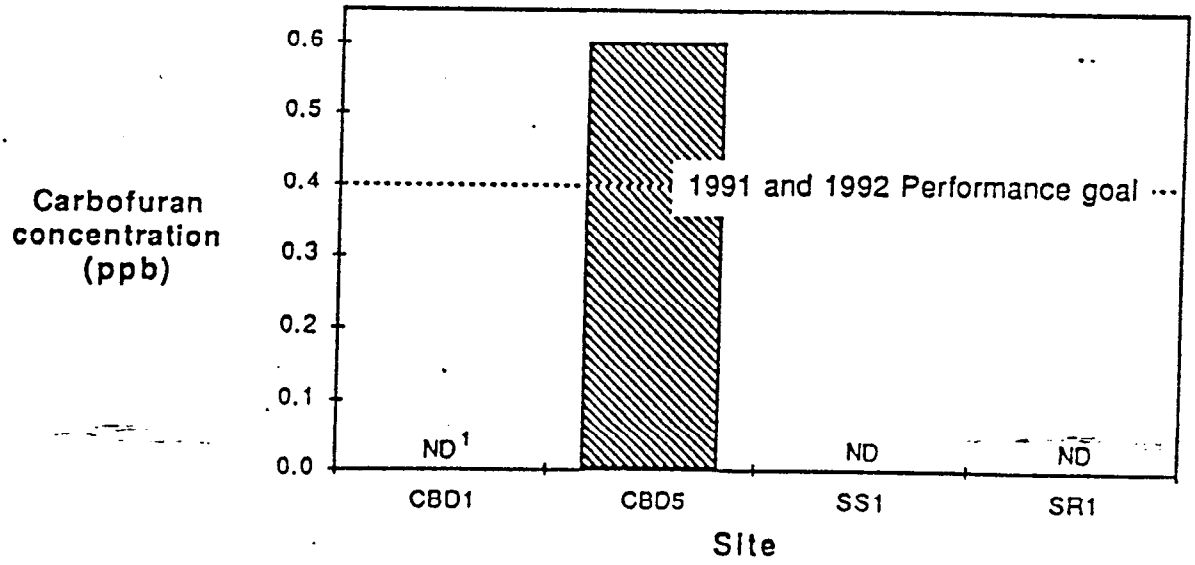


Figure 6. Peak thiobencarb concentrations in the Sacramento River at Sacramento in 1982-1991 and the secondary action level for thiobencarb.



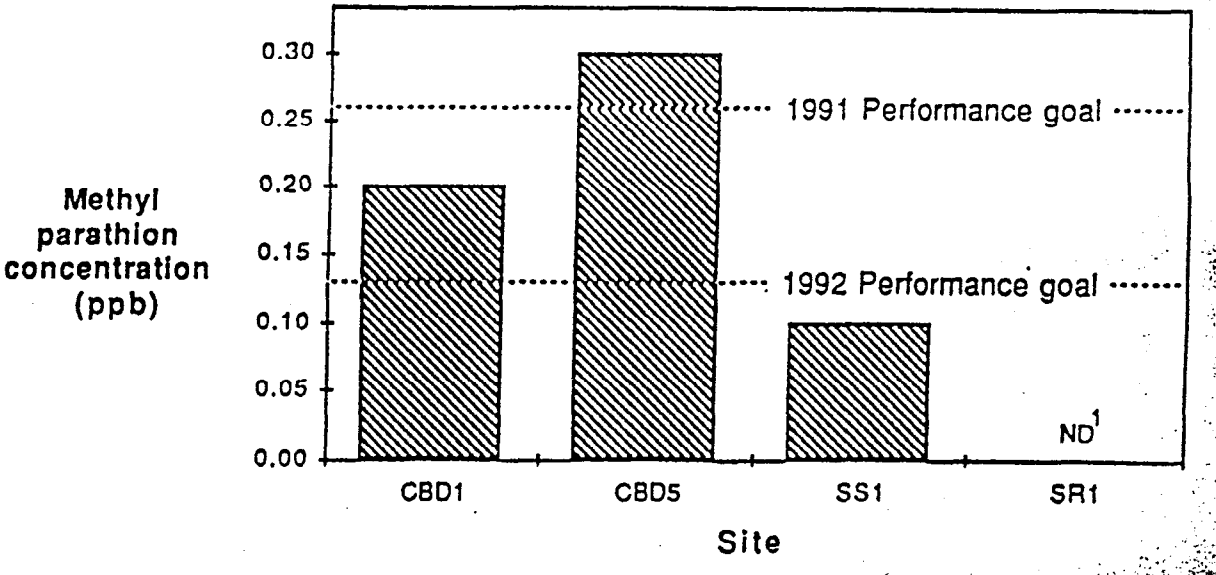
ND None detected. Limit of detection = 0.1 ppb.

Figure 7. Peak carbofuran concentrations in Sacramento Valley waterways in 1991 and carbofuran performance goals for 1991 and 1992.



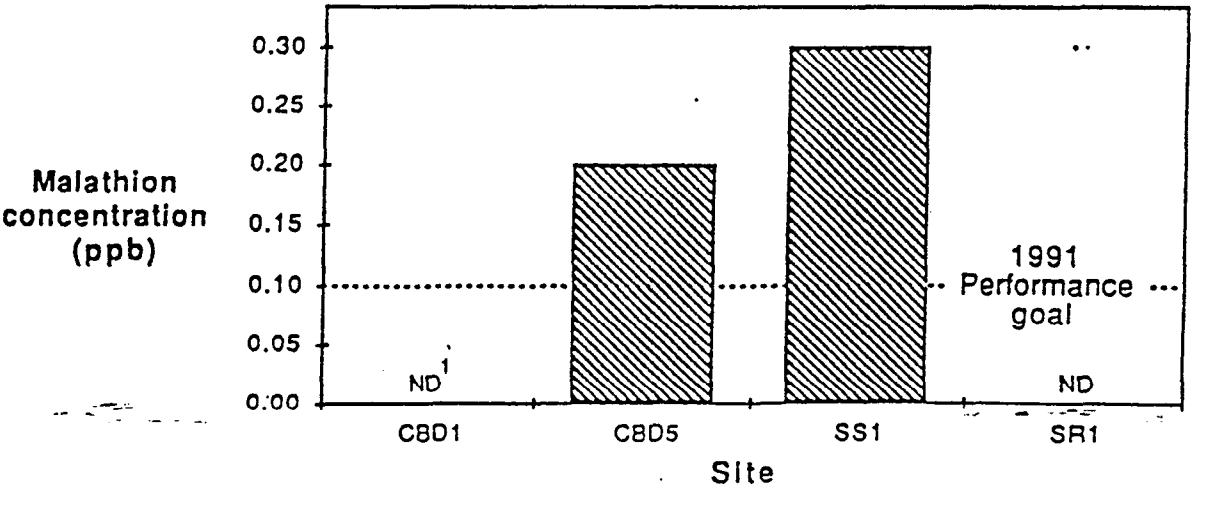
ND None detected. Limit of detection = 0.4 ppb.

Figure 8. Peak methyl parathion concentrations in Sacramento Valley waterways in 1991 and methyl parathion performance goals for 1991 and 1992.



ND None detected. Limit of detection = 0.1 ppb.

Figure 9. Peak malathion concentrations in Sacramento Valley waterways in 1991 and the malathion performance goal for 1991.



ND None detected. Limit of detection = 0.1 ppb.

Figure 10. Acres treated with molinate (open bars) and thiobencarb (filled bars) in the Sacramento Valley in 1991, the deviation of maximum daily temperatures from the 30 year maximum temperatures, and the single rain event over 0.25 inches (arrow).

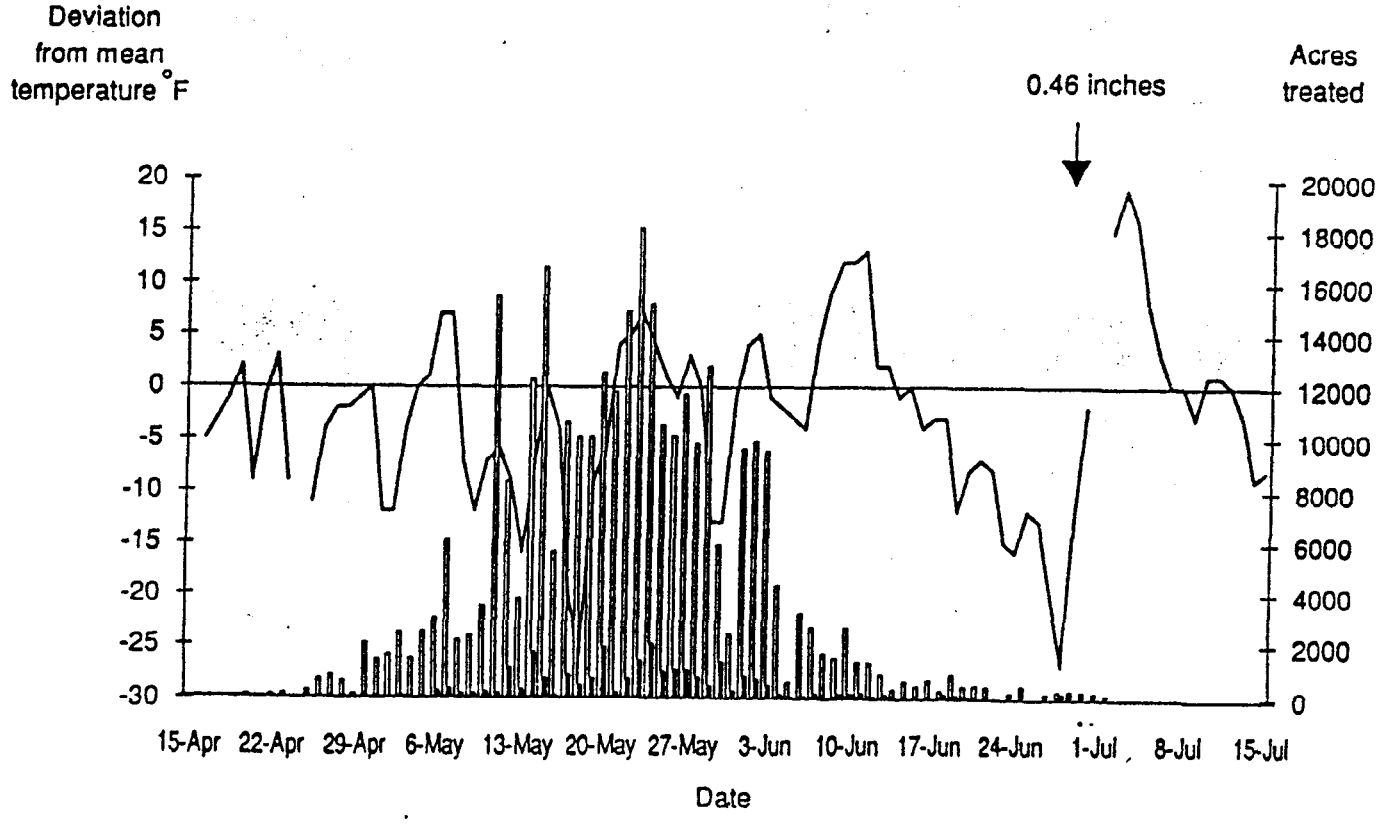


Figure 11. Acres of rice treated with molinate in Glenn and Colusa Counties (bars) and concentrations of molinate in water samples collected from the Colusa Basin Drain at SR20 (CBD5) (squares) in 1991.

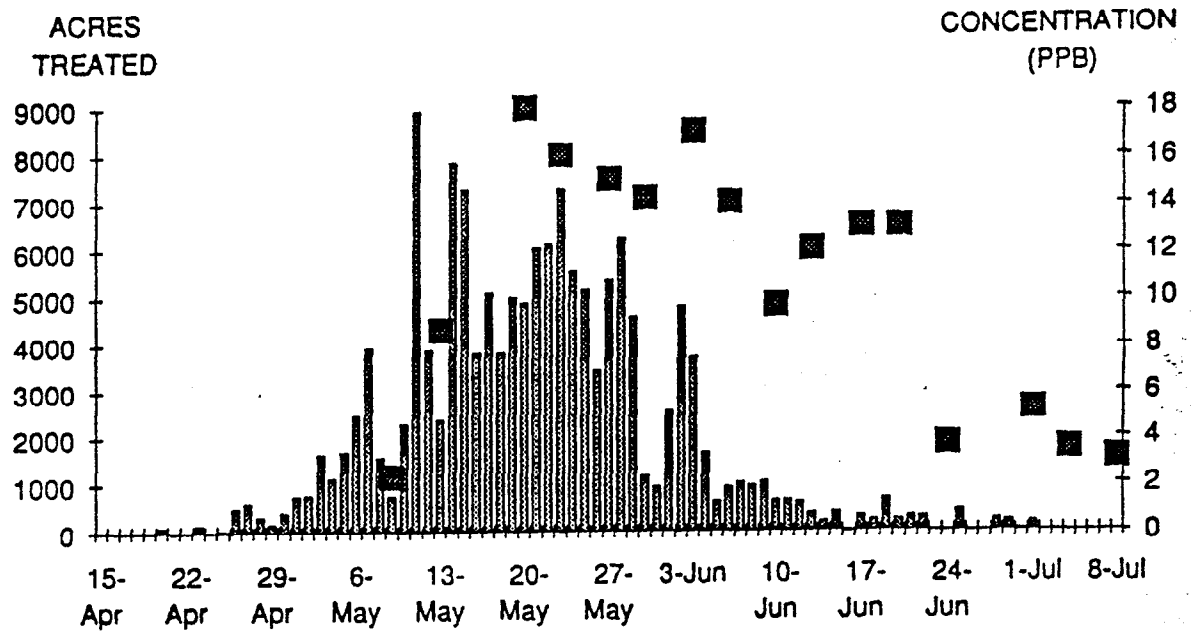


Figure 12. Acres of rice treated with molinate in Butte County (bars) and concentrations of molinate in water samples collected from Butte Slough at SR20 (BS1) (squares) in 1991.

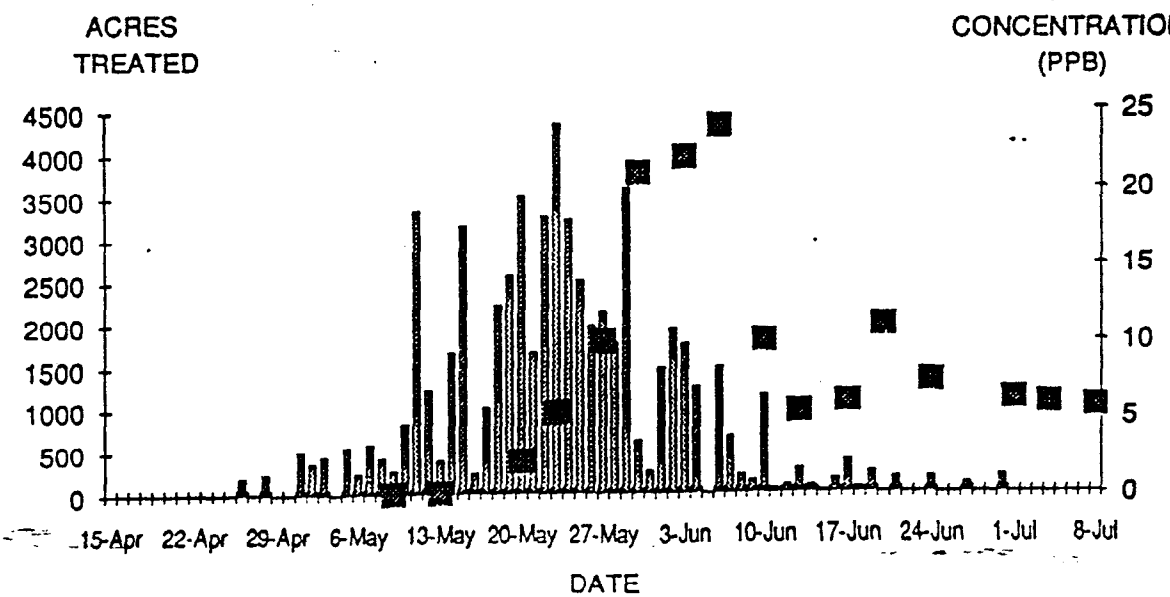


Figure 13. Acres of rice treated by air with carbofuran in Glenn and Colusa Counties (bars) and concentrations of carbofuran in water samples collected in the Colusa Basin Drain at SR20 (CBD5) (squares) in 1991.

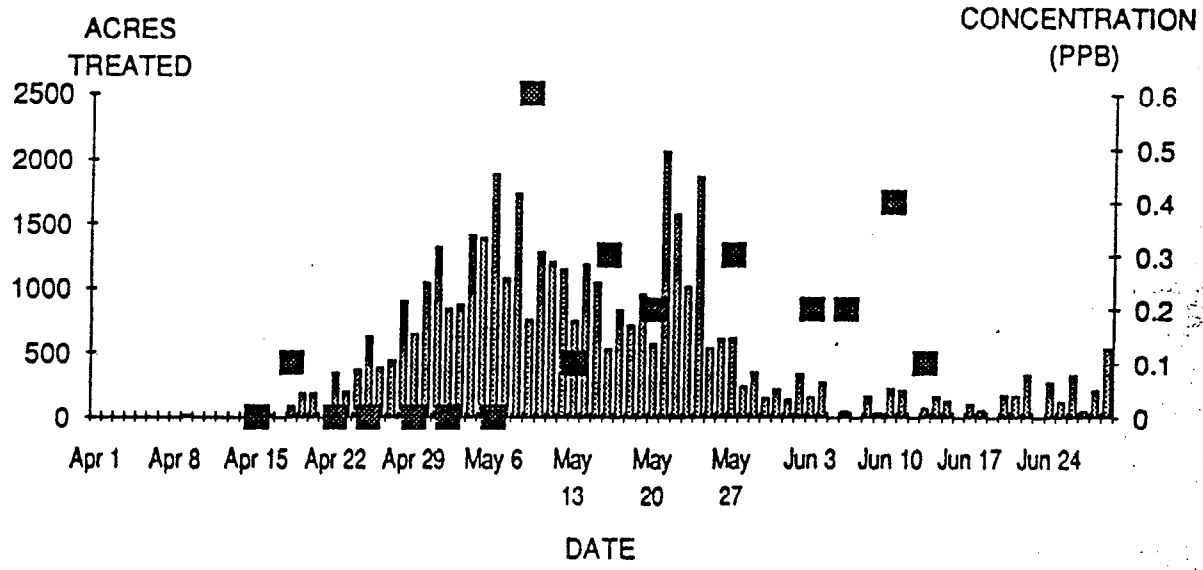
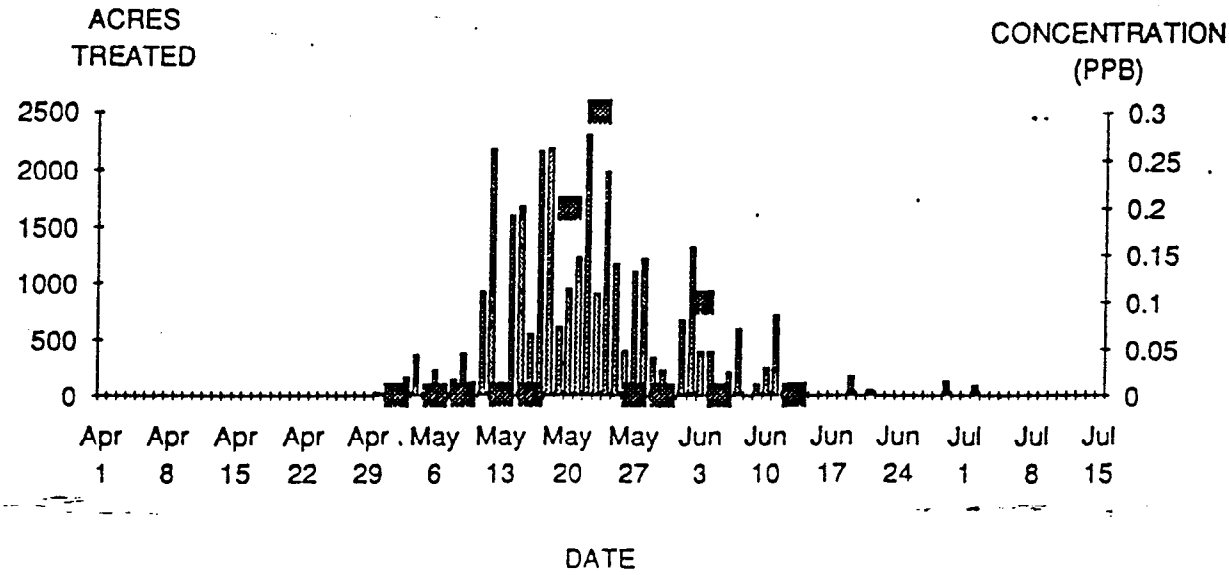


Figure 14. Acres of rice treated by air with methyl parathion in Glenn and Colusa Counties (bars) and concentrations of methyl parathion in water samples collected from the Colusa Basin Drain at SR20 (CBD5) (squares) in 1991.



Appendix 1

FURADAN (Carbofuran), METHYL PARATHION, AND ORDRAM (Molinate)

EMERGENCY RELEASE

Grower:_____ Permit No.:_____

Address:_____ Zip:_____

Field location:_____ Site No.:_____
(Attach detailed map)

Chemical applied:_____
Rate of application:_____
Date of application:_____
Average water depth
at time of application:_____

Chemical applied:_____
Rate of application:_____
Date of application:_____
Average water depth:_____
at time of application:_____

Chemical applied:_____
Rate of application:_____
Date of application:_____
Average water depth
at time of application:_____

Chemical applied:_____
Rate of application:_____
Date of application:_____
Average water depth
at time of application:_____

Starting date of emergency release:_____

Acres in field:_____ Laser leveled? Yes_____ No_____

Type of irrigation system: Flow through____ Recycle____ Static____ Other____

Date flooding began:_____ No. of days it takes to fill field:_____

Describe problem that led to emergency release:_____

_____

Steps that can be taken to prevent emergency releases from this field in future years:_____

_____

_____

Recommendation (attached) by:_____

Application by:_____

Grower's signature:_____ Date:_____

Approved by:_____
Agricultural Biologist

Appendix 2

EMERGENCY RELEASE FORM

Grower:_____ Permit No.:_____

Address:_____ Zip:_____

Field location:_____ Site No.:_____

Beginning date of release:_____ Ending date:_____

The grower must determine the amount of water discharged during the emergency release period. To do this, measure the width of each weir opened to allow the discharge. Then, on a daily basis, measure the height of water flowing over each weir. Record all information in the table below.

WEIR #1		WEIR #2		WEIR #3	
Width:		Width:		Width:	
Date	Height of water	Date	Height of water	Date	Height of water

1991 MALATHION USE

The Central Valley Regional Water Quality Control Board has approved a water management practice following malathion use in rice that will help meet 1991 performance goals for malathion in surface water. Malathion is currently not a restricted material and not subject to use requirements or permit conditions. However, it is important that growers comply with this practice.

Water treated with malathion should be held on the site of application for at least four days following application.

Water quality monitoring will be conducted in 1991 to determine the adequacy of this practice in decreasing malathion discharges. In 1990, malathion monitoring levels exceeded 1991 performance goals approximately six fold. If malathion levels are not adequately reduced, a more formal regulatory program may be implemented in future years.